Spring 2017

Black Bugbane & The Blues: Interactions Between our Wildflower of the Year and the Insect World

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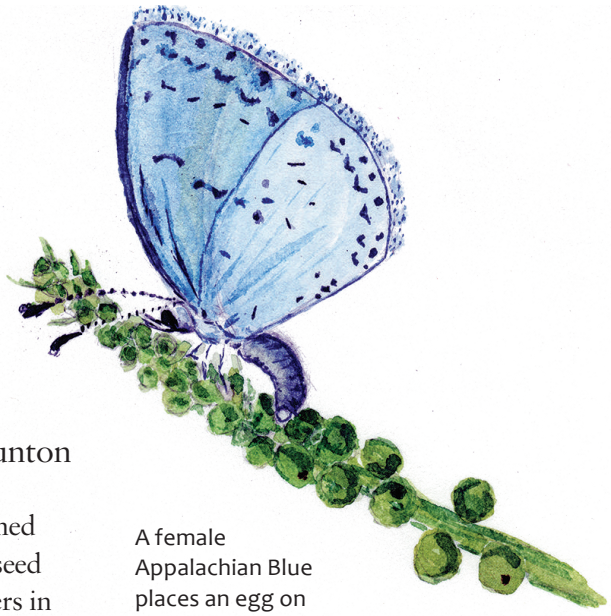


A female Appalachian Blue places an egg on *Actaea racemosa.*

No, this article has nothing to do with American Roots music. Black Bugbane is one of several common names for the 2017 VNPS Wildflower of the Year, *Actaea racemosa*. And Blues refers to a subfamily of lycaenid butterflies, commonly referred to as Blues or Azures. The interactions between Black Bugbane, a.k.a., Black Cohosh, Appalachian Azure butterflies (*Celastrina neglectamajor*), and ants was recently summarized by VNPS charter member and past president Nicky Staunton (2015). In brief, Black Bugbane is the sole food source for caterpillars of Appalachian Azure butterflies, a situation that, superficially, might seem like any other caterpillar and host plant association. As is so often the case, however, it is the details that make this story exceptional. First, these gray, sluglike caterpillars feed preferentially on flowers and flower buds of Black Bugbane. Further, as they feed, they create minute vibrations that summon the attention of ants, who, in turn, feed on secretions produced by the caterpillars. In essence, the caterpillars process plant flowers and buds into food that ants readily consume. In return, ants will aggressively defend both plant and caterpillars from other animals. As long as there are not too many caterpillars per plant, unconsumed flowers will complete fruit and seed production, and all three partners in the relationship benefit: caterpillars become butterflies, Black Bugbanes make seeds, and ants get fed for their efforts.

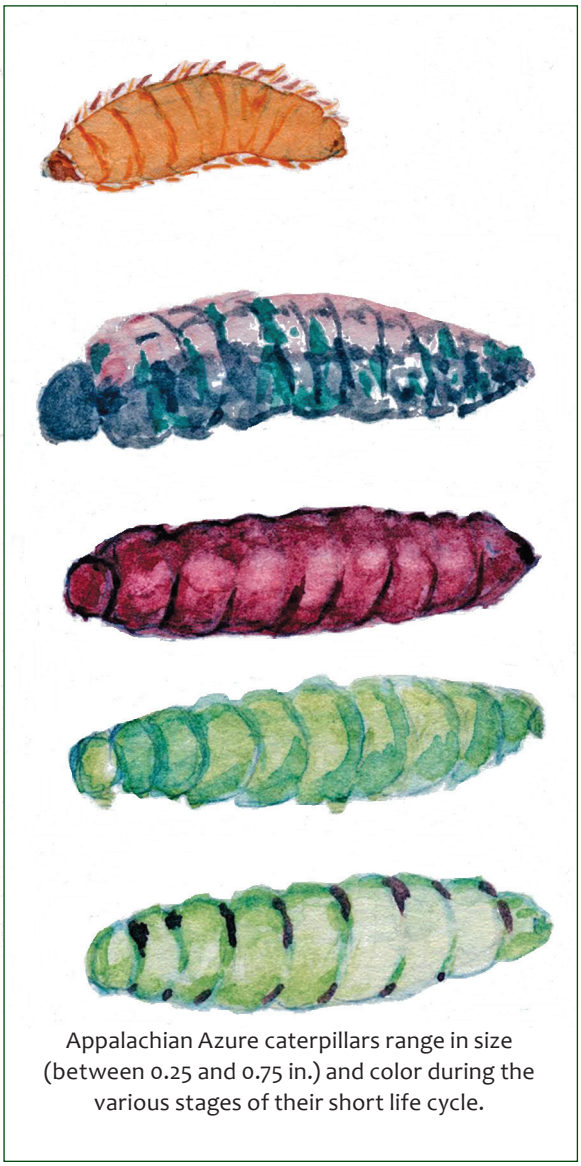
While learning about Black Bugbanes and their Blue/Azure butterflies, I started reading about related butterflies and their host plants, and I was struck, on the one hand, by the broad parallels in the relationships between these other Blues and their host plants. On the other hand, the small differences in their natural histories were intriguing.

One of the first things that I learned was that there are several similar and, evidently, closely related Azure butterflies in eastern North America that use flowers as larval food plants. In addition to the Appalachian Azure, a specialist restricted to flowers and buds of Black Bugbane, we have: the Spring Azure, whose primary food plant is Flowering Dogwood (*Cornus florida*), but it is also known to use Blueberry and Viburnum flowers; the Summer Azure, whose primary flood plants are summer-flowering shrubby Dogwoods (e.g., *Cornus ammomum*) as well as a variety of other plants; and the Cherry Gall Azure, also known to consume flowers of various plants but, as the name implies, it feeds mainly on the finger galls commonly found on the upper leaf surface of Black Cherry (*Prunus serotina*)—which is flat-out, mind-bendingly bizarre. Tiny little mites form minute finger galls on the leaf and the caterpillars eat the finger galls, mites and all!

Dorsal views of Appalachian Blues, female, left, and male. This is the largest Azure butterfly.

Though morphologically similar, and evidently closely related, these butterflies exploit different food resources. As such, these caterpillars and their food preferences illustrate the general ecological principle known as niche differentiation; because food is the distinguishing environmental factor involved, this appears to be a special case of niche

differentiation called resource partitioning. What's interesting is that specializing on flowers (or other highly seasonal food items like finger galls on cherry leaves) has profound effects on other aspects of the natural history of these butterflies. For example, seasonal emergence, mating, and egg-laying by adult butterflies are necessarily closely tied to host plant flowering season (or gall formation). Of the species discussed here, the Spring Azure is active in early spring, and because the flowering period of Flowering Dogwood is relatively brief, this butterfly is univoltine—adults have to emerge and mate and females have to lay their eggs to initiate the next generation at just the right time for those hungry little caterpillars to have access to buds and flowers of Flowering Dogwood. Consequently, there is just a single generation of Spring Azures per year, which is the definition of univoltine. In contrast, food plants for the Summer Azure bloom all summer long; these butterflies can be active from June to October and may progress through two or three generations per season—i.e., it is multivoltine. Wedged between the flight periods of Spring and Summer Azures, we have flights of the Appalachian Azure and the Cherry Gall Azure; these are both univoltine species for which the establishment of their new generation coincides with flowering time of Black Bugbane and the emergence of cherry leaf finger galls, respectively.



Appalachian Azure caterpillars range in size (between 0.25 and 0.75 in.) and color during the various stages of their short life cycle.

For these Azure/Blue species, host food plant preference exerts profound influence on other aspects of the natural history of these closely related butterflies. We have seen how food preference influences time of breeding season and number of broods per year. Because breeding seasons are separated in time, it is unlikely that Spring Azures will have an opportunity to mate with Summer Azures, and the same can be said of other combinations of butterflies within this group. These Azure/Blue butterflies appear to be reproductively (genetically) isolated from one another—at least to a large extent. As reproductively isolated entities, each species occupies a different evolutionary trajectory.

Another consequence of specializing to a host plant is the acquisition of some sort of biochemical strategy for dealing with the different protective compounds produced by these plants. Black Bugbane makes steroidlike molecules, dogwoods protect themselves with iridoids, and cherries defend themselves with molecules that release cyanide. To some extent, feeding preferentially on buds and flowers might be part of the toxin-avoidance strategy that three of these species of caterpillar employ, because flowers and buds are likely to contain lower concentrations of protective compounds than leaves or mature fruits and seeds. Nevertheless, some facility in overcoming a host plant's toxins is essential. An anecdotal observation illustrates the importance of adapting to particular plant toxins. Appalachian Azure caterpillars can eat toxic Black Bugbane leaves if the host plant has been depleted of buds and flowers; Summer Azure caterpillars will also eat Black Bugbane buds and flowers, but they will die if forced by necessity to eat leaves of the same plant.

It may be common to think of plants as hapless victims of herbivores, and perhaps to some extent they are. But plants do fight back with chemistry and, over time, the diverse molecules they deploy have profound impacts on their herbivores. If you are an Appalachian Azure caterpillar, you are what you eat, and what you eat is Black Bugbane. Black Bugbane not only made the physical substance of every Appalachian Azure flitting in the forest, it also determined profoundly important aspects of their natural history.

WORK CITED

Staunton, N. 2015. Fairy candles, butterflies and ants. Blazing Star 16(2): 13–15. [Reprinted in Wild News (04): 3–4.]